In the last few decades considerable percentage of population reside in locations connected to sewers and served by wastewater treatment; this trend is increasing. Many new plants now provide advanced secondary and sometime tertiary treatments, many existing plants are upgraded from primary to secondary treatments and those with existing secondary treatment to advanced biological nutrient removal treatment. However, many places in the world continue to discharge untreated or poorly treated wastewater into oceans, lakes, or rivers.

Some of the challenges that treatment plant managers face are:

1. Growing urban population, increase in volumes of effluent, which are already enormous.
2. Public awareness to build new treatment facilities where they do not exist, and improve the degree of treatment where they do exist.
4. Reduction or elimination of CSO (Combined Sewer Overflow) and better management of storm water.
5. Aging of collection and treatment infrastructures.
6. Building new or improving the existing infrastructure are very time consuming and expensive.
7. Energy costs are increasing and stock of fossil fuel reducing.
8. Budget constraints for the Government, as many other essential departments like health, police, and fire fighting share the same budget.

The above challenges must be met with more innovative approaches/solutions like automation of collection systems and treatment processes. These approaches/solutions will diminish the impact of the effluents and reduce the cost of impact. Siemens provides measurement and control solutions for wastewater collection, wastewater and sludge treatment processes and their disposal. We will discuss some of the typical solutions here.

**Collection system**

Sewer flow monitoring and recording in sewers is an important measurement. Siemens provides the world’s best open channel flow meter (OCM III) with an accuracy of +/- 1mm/meter using non-contact ultrasonic technology, the data of flow rate and total flow are logged by the OCM III and transmitted remotely using telemetry. It is superior over hydrostatic or other contact type sensors that fouls due to built-up of debris, loss of calibration, and become unreliable over a period. The pumping stations provide a head to the effluent to enable it to flow by gravity to the treatment plant. The pumps are big consumers of energy and expensive to maintain. The Siemens EnviroRanger LUC 500, the MultiRanger 100, and the HydroRanger 200 pump controllers are an optimum solution for the pump control and providing remote access to the stations. It reduces the maintenance and operating costs by improving the efficiency with digital technology. It increases the life of pumps by having various pump control routines and advanced pump control modifiers. It provides reliable performance in difficult and tight environment due to excellent transducer design and patented process intelligence software. It reduces energy costs by minimizing the pump running in high-tariff time zones without compromising the safety of the process. It warns the customer locally and/or remotely for abnormal events. It offers complete transparency for configuration and troubleshooting to the operators. These instruments offer stand alone solution and can be integrated as well into SCADA/DCS systems, like Simatic WinCC or Simatic PCS 7.

Siemens magnetic flow meters, Sitrans Mag 5000 transmitter with 5100 W sensor, continuously monitor the pump station discharge. They offer superior accuracy at low flows due to patented coned meter design. "Sensorprom", a micro chip mounted in the sensor stores the calibration data and user configuration data and uploads these data into the new transmitter enabling it to operate without any reconfiguration.

Siemens offers the best in situ verification of the sensor health and the transmitter accuracy, and prints out a report comparing the actual meter data with the data stored in the Sensorprom. This results into cost savings for the user, as he has not to take the meter out of service and send to the manufacturer to check for accuracy and its health. The more powerful Mag 6000 transmitter offers +/- 0.25% accuracy of the reading and provides flexibility to integrate the flow meter into various digital networks through add-on communication modules.

Siemens offers magnetic flow meters from 2 mm to 2000 mm size in various configurations with numerous choices of liners, and electrodes to help the customer select the most optimum unit to suit the application.

Siemens also offers solutions like clamp-on ultrasonic flow meters to measure the flow rates of station discharge. The advantage of this technology is that the user does not have to cut the pipes to install the meter. Both Doppler and transit time transducers can be integrated in the transmitter making it suitable to work in clean water and water with lots of suspended particles and aeration like effluent water. Also, the clamp-on flow meters are available for portable or permanent installations.
Preliminary treatment: The large solids are removed by bar screens installed in the influent channels. The solids larger than the gaps between the bars are retained, eventually the screens get plugged and need cleaning. This is automated by installing two ultrasonic transducers, one in the up-stream and one in the down-stream of the screen and connected to the HydroRanger 200. At set differential level, the cleaning rake will be operated by the HydroRanger 200 to facilitate the cleaning. If the rake is broken, the differential rises, and a high level alarm is activated to warn the operator. The unit provides one analogue output each for differential level and upstream or downstream level. HydroRanger 200 can be integrated into the Profibus, Modbus, Device-Net, AB Remote I/O networks using Smarthinx modules.

The Sitrans DS III offers superior accuracy of 0.075% with best long term drift of 0.25% over 5 years with world accuracy of 0.075% with best long term accuracy. The Sitrans DS III measuring the pressure in the grit wash water line.

Primary treatment: 40% of total solids are removed by retaining the effluent in clarifier tanks for long periods of time. The sludge blanket level transmitter DPS 300 is used to continuously monitor the sludge blanket level under the water to clarify to operate in operational stages and quality of effluent going into the next stages.

Secondary treatment: Also known as biological treatment where organic impurities are removed. Siemens provides solutions for application of level, flow, and pressure measurement in this process. A typical one is showing the Sitrans Magflo Mag 5000 and 5100 W monitoring the flow of activated sludge from secondary clarifiers to the sludge treatment plant. Many chemicals like Lime, Aluminum Sulfate, Ferric Chloride, Aqueous Chlorine etc. are used at various stages of wastewater treatment process such as pH control, flocculation, dewatering, disinfection etc. These chemicals are a big operating cost for any plant. Siemens offers electromagnetic flow meters of both AC and DC pulsed field with many choices of liners and electrodes for customers to accurately monitor the usage of these chemicals.

Tertiary treatment: Removes fine particles, bacteria, and viruses still present in the effluent before the final discharge into the water bodies. Typical applications are: Differential pressure transmitter Sitrans DS III to monitor the differential across the activated carbon/sand filter, and Ultrasonic sensor continuously monitoring the filter bed level.

Sludge treatment process Siemens level, flow, pressure, temperature, and recording instruments are successfully applied and working over a long period of time in this area. A typical example shows radar level transmitter Sitrans LR 200 monitoring the level in an anaerobic digester. Other technologies like bubbler, hydrostatic, differential pressure, non-contact ultrasonic etc. are not reliable due to the presence of methane, carbon dioxide gases, steam above the medium, and foam on the surface. If level is not monitored reliably, then it causes difficult maintenance problems of foam overflowing into the gas collection system. The tank pressure can increase and potentially damage the roof, and hazardous gases escape into the atmosphere.

Utilities The time, carbon powder etc. are stored in big silos for dosing purpose. The customer needs to efficiently maintain the inventory of these materials. Sitrans LR 400 radar level transmitter is installed to efficiently measure the level under severe dusty conditions while filling and emptying where ultrasonic technology is not reliable and customer prefer non-contact radar technology over TDR (Time Domain Reflectometry also known as Guided Wave Radar).

Every treatment plant has storage tanks for chemicals like Alum, sodium hypochlorite, polymers, diesel etc. The Sitrans Probe LU is mounted on the alum tank monitoring the level, it can be configured to monitor material volume as well. The powerful ultrasonic pulse, embedded patented process intelligence, and auto learn feature helps customer to set up the unit quickly and provide reliable measurement for a long time. The user can choose Tefzel or Kynar wetted parts (Kynar is a trade name of PVDF – Poly Vinyl Di Fluoride) to suit the application.

Conclusion Siemens instruments are easy to install, configure, and integrate into the network. Most of the instruments are commissioned, calibrated and diagnosed using Simatic PDM software. Customers prefer PDM to read and configure the instruments locally or remotely without going to the measuring point. More than half a million Siemens process instruments are installed and working in wastewater treatment plants globally for many years.